

Revalidation and redescription of *Pterocryptis anomala* (Herre, 1933), a catfish (Teleostei: Siluridae) from southern China

HEOK HEE NG¹ & BOSCO P.-L. CHAN²

¹ Fish Division, Museum of Zoology, University of Michigan, 1109 Geddes Avenue, Ann Arbor, Michigan 48109-1079, USA (heokheen@umich.edu)

² Kadoorie Farm & Botanic Garden, Lam Kam Road, Tai Po, New Territories, Hong Kong SAR, P. R. China (boscof@kfbg.org)

Abstract

Pterocryptis anomala (Herre, 1933) is resurrected from synonymy with *P. cochinchinensis* (Valenciennes, 1839) and redescribed in this study. This species of catfish from southern China and Hong Kong Special Administrative Region can be distinguished from congeners by the unique combination of the following characters: length of dorsal fin 7.9–10.1% SL, depth of caudal peduncle 7.2–9.7% SL, head length 16.6–20.7% SL, eye diameter 9.2–13.7% SL, dorsal-fin rays 3–4, anal-fin rays 59–69, principal caudal rays 14–16, small conical genital papilla in both sexes, anal and caudal fins separated by a deep notch, narrow cheeks, circular eye and weakly contrasting mottled coloration. Characters for diagnosing *Pterocryptis* species are identified and discussed.

Key words: Zhujiang, Minjiang, Hong Kong, Siluriformes, freshwater fish

Introduction

Catfishes of the genus *Pterocryptis* Peters, 1861, are medium sized members of the Siluridae usually found in fast flowing mountain streams throughout India, southern China and Southeast Asia. *Pterocryptis* had been considered a junior synonym of *Silurus* Linnaeus, 1758, until its rediagnosis by Bornbusch (1991). There are 16 nominal species of *Pterocryptis* (see Ng & Freyhof, 2001). Of these, only *P. cochinchinensis* (Valenciennes, 1839), *P. anomala* (Herre, 1933) and *P. gilberti* (Hora, 1938) have been reported from China. Recent work by Ng & Freyhof (2001) suggests that *P. cochinchinensis* is restricted to central Vietnam. This prompted us to examine *Pterocryptis* from southern China with the objective of clarifying its taxonomic status. Our results show that *P. cochinchinensis* also occurs on Hainan Island (off the southeastern

coast of China) and that material from southern China and Hong Kong Special Administrative Region represent a distinct species for which the name *P. anomala* is available. We therefore redescribe *P. anomala* as a valid species in this study, and treat *P. gilberti* as its junior synonym.

Material & Methods

Measurements were made with dial calipers and data recorded to 0.1 mm. Counts and measurements were made on the left side of the specimens when possible. In tables and text, subunits of the head are presented as proportions of head length (HL). Head length and measurements of body parts are given as proportions of standard length (SL).

The measurements and terminologies follow those of Ng (1999), with the addition of the dorsal-fin height, which is measured from the base to the tip of the longest dorsal-fin ray. Drawings were made using a Wild M5 microscopic camera lucida. Institutional acronyms follow Eschmeyer (1998) with the following exceptions: the University of Hong Kong (HKU), and Kadoorie Farm & Botanic Garden, Hong Kong (KFBG).

Pterocryptis anomala (Herre, 1933)

(Fig. 1)

Herklotsella anomala Herre, 1933: 179 (type locality: Hong Kong).

Parasilurus cochinchinensis (non Valenciennes) - Nichols, 1928: 5 (in part); Nichols, 1943: 35, fig. 5 (in part).

Silurus wynaadensis (non Day) - Tchang, 1936: 35, figs. 1–2; Tchang, 1960: 9, fig. 4.

Silurus sinensis (non La Cèpède, non McClelland) Hora, 1937: 341 (type locality: Lunghow [=Longzhou], China).

Silurus gilberti Hora, 1938: 351 (replacement name for *S. sinensis* Hora, 1937); Haig, 1952: 100; Chen, 1977: 201, pl. 1 fig. 1; Yue, 1981: 177, fig. 146; Kobayakawa, 1989: 163, fig. 17; Dai, 1989: 271, fig. 206; Dai, 1999: 79, fig. 39.

Parasilurus anomalus - Man & Hodgkiss, 1981: 49.

Silurus cochinchinensis (non Valenciennes) - Haig, 1952: 99 (in part); Chen, 1977: 202, pl. 1 fig. 2; Yue, 1981: 178, fig. 147; Chen, 1984: 389, Fig. 263; Dai, 1989: 272, fig. 207; Liu, 1990: 288, fig. 174 (in part); Chong & Dudgeon, 1992: 92; Dai, 1999: 81, fig. 41 (in part).

Material. CAS 126769, holotype, 158.3 mm SL; Hong Kong market. CAS 114841 (2 paratypes), 105.7–126.9 mm SL; data as for holotype. AMNH 10404 (36), 26.5–123.5 mm SL; China: Fujian province, vicinity of Nanping, 26°52'N 118°7'E. AMNH 12142 (38), 47.6–171.1 mm SL; AMNH 233617, 170.8 mm SL; China: Fujian province, Fuqing, Shizhu valley, 25°44'N 119°24'E. ASIZB 72972 (1), 119.7 mm SL; China: Guangxi province, Damingshan Nature Reserve, 23°27'N 108°26'E. ASIZB 72973 (1), 62.1 mm SL; China: Jiangxi province, Jiulianshan Nature Reserve, 570 m a.s.l., 24°35'N 114°28'E.

ASIZB 72974 (1), 78.6 mm SL; China: Guangdong province, Chebaling Nature Reserve, 520 m a.s.l., 24°42'N 114°10'E, 17 Aug 2000. ASIZB 72975 (1), 104.4 mm SL; China: Guangxi province, Damingshan Nature Reserve, 23°27'N 108°26'E. CAS 130371 (1), 89.5 mm SL; CAS 131659 (1), 132.0 mm SL; Hong Kong. HKU 283 (1), 96.7 mm SL; Hong Kong: New Territories, Lau Shui Heung. HKU 284 (1), 114.8 mm SL; Hong Kong: New Territories, Ho Chung. HKU 285287 (3), 99.6–160.6 mm SL; Hong Kong: Lantau Island, Tong Fuk. HKU 288 (1), 110.4 mm SL; Hong Kong: Lantau Island, Sha Lo Wan. HKU 289 (1), 53.7 mm SL; Hong Kong: New Territories, Lam Tsuen. KFBG 281 (1), 127.5 mm SL; China: Guangdong province, Nanling Nature Reserve, Longtanjiao station, 350 m a.s.l., 25°0'N 112°0'E. KFBG 287 (1), 96.2 mm SL; China: Guangdong province, Guanyinshan Nature Reserve, 300 m a.s.l., 23°58'N 113°30'E. ZRC 45958 (1), 121.4 mm SL; Hong Kong: New Territories, Tai Shui Hang. USNM 293933 (1), 68.5 mm SL; China: Guizhou province, Beipanjiang.



FIGURE 1. *Pterocryptis anomala*, HKU 286, 130.0 mm SL; Lantau Island.

Diagnosis. *Pterocryptis anomala* can be distinguished from *P. cochinchinensis*, the only other congener found in southern China, in having a small conical papilla in both sexes (vs. long conical papilla in male *P. cochinchinensis* and large leaf-shaped papilla in female *P. cochinchinensis*; Fig. 2), and a deeper caudal peduncle (7.2–9.7% SL vs. 6.2–7.6). The key characters distinguishing *P. anomala* from other congeners are presented in Table 1.

Description. Biometric data is given in Table 2. Body laterally compressed. Head somewhat depressed. Dorsal profile straight, descending gently from dorsal-fin origin to snout tip. Anterior profile of snout rounded. Anterior pair of nostrils tubular and anteromedial to maxillary barbel base. Posterior pair of nostrils bordered by fleshy dorsal and ventral membranes and situated posteromedial to maxillary barbel base. Eyes small, subcutaneous; located in anterior half of head; visible dorsally, but not ventrally.

Mouth subterminal; gape horizontal or very slightly oblique. Well-developed rictal fold present, consisting of large and fleshy upper lobe joined at corner of mouth with lower lobe; lower lobe subtended by short submandibular groove.

Teeth villiform. Dentary teeth in slightly curved, elongate bands narrowing posteriorly, reaching from symphysis almost to mouth corners; premaxillary teeth in

broader, slightly curved rectangular bands; vomerine teeth in a single crescent-shaped band.

TABLE 1. Key distinguishing characters between *Pterocryptis anomala* and all congeners (except *P. cochinchinensis*). N=number of specimens examined.

Species (N)	Distinguishing character(s)	Condition in species	Condition in <i>P. anomala</i> (n=61)
<i>Pterocryptis berdmorei</i> (26)	Dorsal-fin height Caudal peduncle depth Principal caudal rays	2.6–4.5% SL 7.2–9.7% SL 17–18	7.9–10.1% SL 5.1–6.3% SL 14–16
<i>Pterocryptis bokorensis</i> (1)	Head length	12.4% SL	16.5–20.7% SL
<i>Pterocryptis buccata</i> (3)	Caudal peduncle depth Cheeks	6.8–7.4% SL Inflated (prominent mandibular muscles)	7.2–9.7% SL Narrow (mandibular muscles not prominent)
<i>Pterocryptis burmanensis</i>	Anal fin rays	73–75	59–69
<i>Pterocryptis crenula</i> (3)	Notch separating anal and caudal fins	Shallow	Deep
<i>Pterocryptis cucphuongensis</i> (2)	Anal-fin rays	51–54	59–69
<i>Pterocryptis furnessi</i>	Anal-fin rays Coloration	42–55 Strongly contrasting	59–69 Weakly contrasting
<i>Pterocryptis gangelica</i> (6)	Anal-fin rays	67–75	59–69
<i>Pterocryptis indicus</i> (1)	Anal-fin rays Dorsal fin rays	85 1	59–69 3–4
<i>Pterocryptis inusitata</i> (8)	Caudal peduncle depth Eye shape	7.2–9.7% SL Elliptical	7.2–9.7% SL Circular
<i>Pterocryptis verecunda</i> (3)	Caudal peduncle depth Genital papilla	6.2–7.2% SL Concealed by fold of skin behind anus	7.2–9.7% SL Prominent
<i>Pterocryptis wynaadensis</i> (4)	Eye diameter	7.4–9.3% HL	9.2–13.7% HL

Maxillary barbels slightly flattened, reaching to anterior third of anal fin. One pair of mandibular barbels present; located slightly anterolateral to gular fold; barbels flattened for most of length, reaching to middle of pectoral-fin base.

Gill membranes separate and overlapping, free from isthmus. Branchiostegal rays 9 (3), 10 (35), 11 (18), 12 (4) or 14 (1). Gill rakers short, anteriormost rakers on lower first arch small and widely spaced; 2+4 (6), 1+6 (3), 2+5 (9) 2+6 (1), 3+5 (8), 4+5 (1) or 3+7 (1).

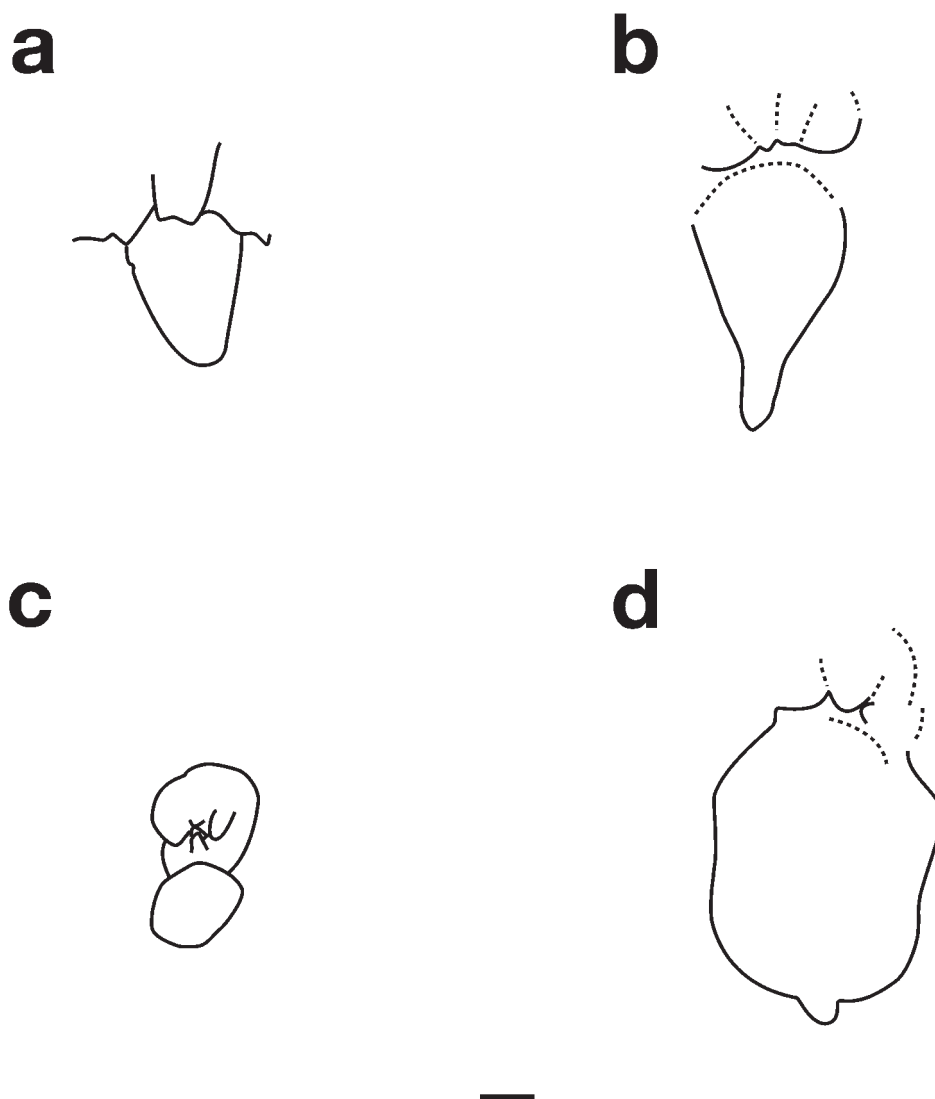


FIGURE 2. Genital papilla of *Pterocryptis* species: a. *P. anomala*, male, KFBG 281, 127.5 mm SL; b. *P. cochinchinensis*, male, AMNH 227902, 144.5 mm SL; c. *P. anomala*, female, HKU 286, 130.0 mm SL; d. *P. cochinchinensis*, female, AMNH 227874, 146.9 mm SL. Scale bar indicates 1 mm.

Distal margin of dorsal fin pointed, with i,2,i (50) or i,3,i (11) rays; segments of first ray not co-ossified to form spine. Distal margin of pectoral fin broadly convex, with 9 (1), 10 (5), 11 (46) or 12 (9) rays. Segments of the proximal two-thirds of first pectoral-fin element co-ossified, forming spine. Pectoral spine and articulated segments sexually dimorphic in mature individuals. Spine in males with broad and somewhat flattened dorsoventrally, with 5–9 serrations on posterior edge, increasing in size distally; proximal articulated segments with 0–6 serrations on posterior edge. Spine in females or juveniles

slender, with 0–7 small serrations on posterior edge, and 0–3 serrations on posterior edges of proximal articulated segments. Distal margin of pelvic fin convex, with i,6,i (44) or i,7,i (17) rays. Distal margin of anal fin straight, with 59 (7), 60 (4), 61 (10), 62 (6), 63 (9), 64 (4), 65 (3), 66 (8), 67 (5), 68 (3) or 69 (2) rays; joined to caudal fin for length of last anal-fin ray. Integument over anal fin thickened proximally for slightly more than half of ray lengths; fin-ray erector muscles extending along anterior edges of anal-fin rays, ventralmost extent of muscles that of thickened integument. Caudal fin emarginate; principal rays i,6,6,i (34), i,6,7,i (25), i,7,6,i (1) or i,7,7,i (1).

TABLE 2. Biometric data for *Pterocryptis anomala* (n=61).

	Range	Mean±SD
% SL		
Predorsal length	25.9–32.5	29.7±1.51
Preanal length	33.9–41.1	37.4±1.63
Prepelvic length	30.3–40.1	33.0±1.75
Prepectoral length	14.6–21.4	18.1±1.04
Dorsal-fin height	7.9–10.1	8.8±0.64
Length of dorsal-fin base	0.8–2.3	1.5±0.36
Length of anal-fin base	53.9–68.5	64.0±2.60
Pelvic-fin length	5.9–9.1	7.7±0.66
Pectoral-fin length	9.6–14.4	12.5±1.17
Pectoral-spine length	3.4–7.5	5.4±0.80
Caudal-fin length	13.6–20.2	16.6±1.42
Body depth at anus	11.2–18.2	13.7±1.20
Caudal peduncle depth	7.2–9.7	8.3±0.69
Head length	16.6–20.7	18.6±0.96
Head width	11.2–15.8	12.6±0.95
Head depth	7.5–11.4	8.8±0.81
% HL		
Snout length	30.8–41.3	38.1±2.92
Interorbital distance	43.0–57.7	50.3±3.01
Eye diameter	9.2–13.7	11.0±1.02
Maxillary barbel length	168.6–272.6	216.8±25.05
Inner mandibular barbel length	60.0–115.8	90.0±12.49
Outer mandibular barbel length (when present)	67.5	

Urogenital papillae of both sexes located immediately posterior to anus. Males (9 specimens examined, 78.2–171.1 mm SL) with a small conical papilla; females (16 specimens examined, 62.1–144.8 mm SL) with a similar shaped, but smaller, slightly broader papilla.

Vertebrae 14+39=53 (1), 13+41=54 (2), 14+40=54 (5), 15+39=54 (1), 13+42=55 (1), 14+41=55 (7), 15+40=55 (9), 14+42=56 (4), 15+41=56 (19), 16+40=56 (3), 14+43=57 (2), 15+42=57 (5) or 16+41=57 (2).

Coloration. In 70% ethanol: flanks and thickened integument over anal fin pale brown, with indistinct randomly distributed irregular dark patches. Dorsal surface and sides of head uniformly brown. Ventral surfaces of head, breast and belly yellow with scattered melanophores; melanophores less dense ventral to level of eye. Maxillary and mandibular barbels brown, fading to yellow distally. Anal fin with hyaline ventral margin. Caudal, pectoral and pelvic fins hyaline, with occasional small dark-brown spots.

Colour in life similar, except for more variation (yellow, brown or greenish) and lack of dark patches on dorsal surface and sides of head (Fig. 3).



FIGURE 3. *Pterocryptis anomala*, ca. 150 mm SL, Guangdong province, showing live coloration of this species (specimen not preserved). Photograph courtesy of H. Zhou.

Distribution. Minjiang and Zhujiang (Pearl River) drainages southwards to the streams draining the territory of Hong Kong Special Administrative Region, China (Fig. 4). In Hong Kong, the species occurs in the New Territories (adjoining the coast of southeastern China) and Lantau Island. This species is not known from Hong Kong Island.

Habitat and ecology. *Pterocryptis anomala* is found in habitats from sea level to at least 760 m a.s.l. (M. Lau, pers. comm. to BPLC). It prefers boulder-strewn, fast-flowing streams with step-pool formation. The fish are largely nocturnal and hides amongst rocks

and submerged plant roots during the day, but can be seen during overcast days or in shaded stream pools. When active, *P. anomala* hovers near the streambed searching for small invertebrates. Stream water in Hong Kong is typically soft, slightly acidic, with a conductivity of less than 50 μ S/cm, and dissolved oxygen level between 0.4–1.0 mg/L (BPLC, unpubl. data). Fish species typically found syntopically with *P. anomala* include *Parazacco spilurus spilurus*, *Psuedogastromyzon myersi*, *Liniparhomaloptera disparis disparis*, *Schistura fasciolata*, *Oreonectes platycephalus*, and *Rhinogobius duospilus*.

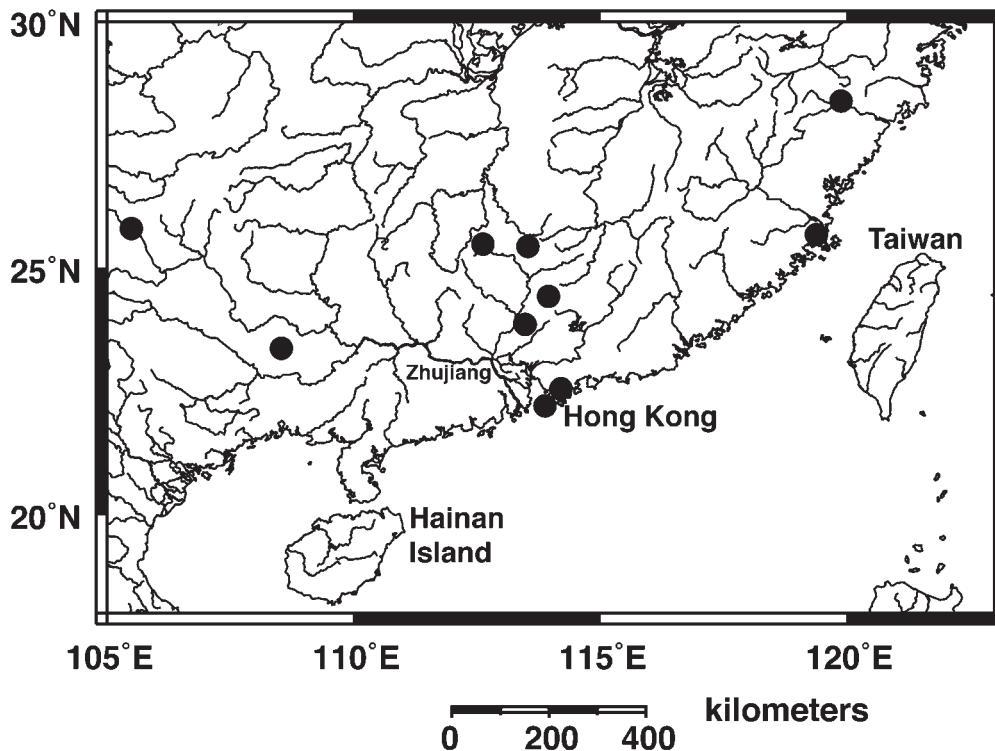


FIGURE 4. Map showing collection localities of *Pterocryptis anomala*.

Discussion

In the original description of *P. anomala*, the lack of pelvic fins in the holotype was the basis of its placement in a separate genus (*Herklotsella*). Since then, Bornbusch (1991) found that the lack of pelvic fins is a teratology that commonly occurs in the Siluridae. In previous studies (see below), the validity of *P. anomala* has not been discussed in detail. Kobayakawa (1989) did not mention this species; Bornbusch (1991) noted this omission but did not further discuss the status of *P. anomala*. Most recently, Ng & Freyhof (2001) tentatively considered *P. anomala* a junior synonym of *P. cochinchinensis* following Haig (1952) and Chen (1977). Our examination of material from Hong Kong and southern

China shows that *P. anomala* is not conspecific with *P. cochinchinensis* and is a distinct species.

Our study shows that *Pterocryptis cochinchinensis* is found only in Hainan Island, southern China and central Vietnam (we could not find any clear differences between the populations in these places). *Pterocryptis cochinchinensis* is a distinctive species easily diagnosed by the large genital papilla of both sexes compared to the size of the genital papilla in congeners. Although we have not examined a significant amount of material from the Red River drainage, we suggest that previous records of *P. cochinchinensis* from the Red River drainage to refer to *P. verecunda* instead of *P. anomala* (based on the known distributions of the species). Furthermore, it is highly likely that material identified as *P. gilberti* from the Red River drainage in northern Vietnam by Mai (1978) refers to *P. cucphuongensis*, as evidenced by the relatively low anal-fin ray count reported (53–59 vs. 51–54 previously recorded for *P. cucphuongensis*).

The diagnostic characters (number of mandibular barbels, shapes of genital papillae and degree of fusion of anal and caudal fins) found useful in distinguishing *Pterocryptis* have been discussed by Ng & Freyhof (2001) in their review of Vietnamese *Pterocryptis*. Our study of the Chinese *Pterocryptis* casts doubt on the utility of the number of mandibular barbels as a diagnostic character, however. It has been recognized that the outer mandibular barbels in some silurid genera (including *Pterocryptis*) regress ontogenetically (Atoda 1935; Majumdar, 1951; Parameswaran et al., 1971; Xie, 1989; Bornbusch, 1995), but Ng & Freyhof (2001) considered the number of mandibular barbels useful as a diagnostic character when comparing specimens of at least 75 mm SL. Our examination of *P. cochinchinensis* reveals that there are individuals larger than 75 mm SL with two pairs of mandibular barbels (KFBG 250, KFBG 251 and KFBG 278). No other differences could be found between the individuals with two pairs of mandibular barbels and others from Hainan Island with one pair of mandibular barbels, so we consider all of this material to be conspecific. Although we have not been able to examine *Pterocryptis* larger than 75 mm SL from mainland southern China with two pairs of mandibular barbels [the only specimen available to us is one of 68.5 mm SL (USNM 293933)], the single specimen with two pairs of mandibular barbels is not otherwise distinguishable from congeners collected from southeastern China (with one pair of mandibular barbels). *Pterocryptis* with two pairs of mandibular barbels have long thought to be a distinct species, *P. gilberti* (e.g. Dai, 1999). As noted above, we were otherwise unable to distinguish between material identified as *P. anomala* and *P. gilberti* (save for number of mandibular barbels). We also note here that Chen (1977) mentioned that material with two pairs of mandibular barbels has a shorter head (14.6–16.1% SL vs. 16.8–17.6), but because we are unable to verify this, we tentatively concur with Ni & Wu (1986) in placing *P. gilberti* in synonymy with *P. anomala*.

Although we have established that variation in the number of mandibular barbels in individuals larger than 75 mm SL exists in *P. cochinchinensis*, it is difficult to extrapolate

this to other species. This is primarily because all other congeners diagnosed in having two pairs of mandibular barbels (i.e. *P. bokorensis*, *P. buccata*, *P. burmanensis*, *P. cucphuongensis*, *P. indicus* and *P. wynaadensis*) are known from very little material (not more than five specimens in each case). These six species have been traditionally diagnosed by the number of mandibular barbels, but in the light of these difficulties, we tentatively regard the six species mentioned above as valid, but have refrained from using the number of mandibular barbels to diagnose them.

We treat the nominal species *Pterocryptis gangelica* Peters, 1861 and *Silurus afghana* Günther, 1864, both of which are known from the Brahmaputra and Ganges River drainages in the northern part of the Indian subcontinent as conspecific. *Pterocryptis* material from northern India is poorly represented in collections and we could not distinguish between the small amount of material identified as either of the two nominal species. Kobayakawa (1989) diagnosed *P. afghana* as possessing tubercles on the snout, but our examination shows that tubercles are present on the snouts of all *Pterocryptis* species, although the tubercles are often small and may be obscured by a thick layer of congealed mucus in preserved material. Furthermore, the tubercles are easily damaged (e.g. when we attempted to remove the layer of congealed mucus by rubbing), making it more difficult to study this character. In summary, it is possible that tubercle shape may be useful in diagnosing *Pterocryptis* species, but its worth could not be fully assessed in our study. We note, however, that tubercle shape has been used as diagnostic characters in other catfish groups, most notably in sisorids (Mo & Chu, 1986) and mochokids (Roberts, 1989; Ng, 2004); its utility as a diagnostic character for silurids warrants further investigation. The tubercles presumably enlarge during breeding, as is the case with other ostariophysans (Wiley & Collette, 1970), but we do not understand enough of the biology of these fishes to be fully certain.

Comparative material

Pterocryptis berdmorei: NRM 29548 (7 paratypes of *Silurus torrentis*), 83.1–153.2 mm SL; Myanmar: Kachin, Putao (Ft. Hertz). NRM 28552 (3 paratypes of *Silurus torrentis*), 145.7–178 mm SL; Myanmar: Tenasserim/Mon, south of Ye, Malvedaung. BMNH 1893.6.30.110 (1), 125.0 mm SL; Myanmar: Shan States, Nampandet. BMNH 1972.7.26.11 (1), 216.2 mm SL; upper Myanmar. UMMZ 245494 (11), 68.0–122.2 mm SL; Myanmar: Kachin, Myitkyina district, hillstreams at Tonpan Village on road from Myitkyina to Tanai. ZRC 2989 (1), 92.5 mm SL; Kedah, Baling. ZRC 41970 (1), 138.6 mm SL; Thailand: Ranong, King Amphoe Suk Sam Lan, Ton Koi waterfall. ZRC 42205 (1), 68.3 mm SL; Thailand: Ranong, Khlong Kho Krue at Ban Cho Krue, km 3.5 on road to Nam Tok Kho Krue, branching E 3 km S of Kra Buri on road to Ranong.

P. bokorensis: MNHN 1936167 (holotype), 124.4 mm SL; Cambodia: Bokor, 800–1000 m altitude.

P. buccata: ZRC 41496 (holotype), 95.6 mm SL; CMK 5993 (paratype), 82.5 mm SL; Thailand: Kanchanaburi, Amphoe Sai Yok, Mae Khlong basin. CMK 12884 (paratype), 146.6 mm SL; Thailand: Kanchanaburi, Sai Yok Noi caves near Nam Tok.

P. cochinchinensis: MNHN 573 (syntype), 115.4 mm SL; MNHN B.602 (syntype), 93.6 mm SL; Vietnam. AMNH 10401 (18), 100.9–158.8 mm SL; AMNH 233616 (1), 124.2 mm SL; China: Hainan Island, within a 24-km radius of Nada. CAS-SU 31763 (2), 118.8–150.9 mm SL; China: Hainan Island, Nada. KFBG 250 (3), 104.2–106.9 mm SL; China: Hainan Island; Bawangling National Nature Reserve, Dongliu, 650 m a.s.l. KFBG 251 (1), 118.0 mm SL; China: Hainan Island, Baisha Xian. KFBG 278 (1), 82.3 mm SL; China: Hainan Island, Qiongzong, Mount Limu, 19°1'N 109°49'E. KFBG 282 (1), 141.1 mm SL; China: Hainan Island, stream near Mount Diaoluo, 18°45'N 109°52'E. USNM 117328 (3), 90.2–195.0 mm SL; China: Hainan Island. USNM 293160 (2), 108.6–110.6 mm SL; USNM 293931 (1), 90.8 mm SL; China: Hainan Island: Changjiang. ZRC 43713 (1), 116.2 mm SL; ZRC 43714 (4), 93.8–162.0 mm SL; China: Hainan Island, Tongzha market. Additional Vietnamese material listed in Ng & Freyhof (2001).

P. crenula: ZRC 46317 (holotype), 125.2 mm SL; CMK 14895 (2 paratypes), 59.0–80.0 mm SL; Vietnam: Quang Ninh, Hai Ninh district, torrent at km 5 on road from Bac Phong Sinh to Mong Cai, 21°35'31"N 107°43'52"E.

P. cucphuongensis: ZMUH 345, (holotype), 89.3 mm SL; Vietnam: Thanh Hoa, Cuc Phuong National Park. ZRC 39524 (1), 90.4 mm SL; Vietnam: Thanh Hoa, Cuc Phuong National Park, stream 16 km from gate.

P. gangelica: BMNH 1860.3.19.735 (holotype of *Silurus afghana*), 110.3 mm SL; India: Assam. CAS 141890 (1), 136.5 mm SL; ZSI F13421/1 (3), 81.5–111.1 mm SL; India: West Bengal, Tista river drainage, Kalimpong Duars and Siliguri Terai. ZMH 2679 (1), 176.8 mm SL; Bhutan: Jamdura.

P. indicus: ZSI FF1699 (holotype), 204.6 mm SL; India: Arunachal Pradesh, Namdapha River.

P. inusitata: ZRC 41455, (holotype), 173.7 mm SL; Laos: Mekong basin, Nam Theun watershed, Nam Ong at Ban Don. CMK 12534 (3 paratypes), 91.5–183.9 mm SL; Laos: Khammouan, Nam Theun, from Ban Signo to about 6 km upriver, 17°50'50"N 105°03'00"N. CMK 12570, (2 paratypes), 78.5–196.9 mm SL; Laos: Khammouan, Nam Theun, immediately upriver of confluence with Nam Ong, 17°43'00"N; 105°16'20"E. ZRC 43393 (2 paratypes), 93.9–96.8 mm SL; Laos: Nam Theun watershed, Nam Ngouang at Ban Sensi.

P. verecunda: ZRC 46316, (holotype), 131.6 mm SL; Vietnam: Hai Phong, Cat Ba Island, stream near eastern entrance of Trung Trang cave, 20°47'17"N; 107°00'04"E. CMK 14821 (2 paratypes), 84.8–97.5 mm SL; Vietnam: Hai Phong, Cat Ba Island, first unnamed stream on road from National Park headquarters to Gia Luan (Ra Luan), 1 km, 20°48'01"N; 106°59'03"E.

P. wynaadensis: AMS B7990 (syntype), 129.0 mm SL; BMNH 1889.2.1.2521–2522

(2 syntypes), 57.6–76.2 mm SL; RMNH 8772 (syntype), 125.0 mm SL; India; Tamil Nadu, Wynaad.

Data on *P. burmanensis* from Khin Thant (1966) and *P. furnessi* from Bornbusch (1991).

Acknowledgments

We thank the following for allowing us to examine material under their care: Melanie Stiassny (AMNH), Mark McGrouther (AMS), Darrell Siebert (BMNH), David Catania (CAS), Maurice Kottelat (CMK), Guy Duhamel (MNH), Sven Kullander (NRM), Martien van Oijen (RMNH), Douglas Nelson (UMMZ), Lynne Parenti (USNM), Horst Wilkens (ZMH), Mai Dinh Yen (ZMUH), Kelvin Lim (ZRC) and A. K. Karmakar (ZSI), and Hang Zhou for permission to use the photograph in Fig. 3. This study was supported by a Block Grant from the Department of Biology, University of Michigan, the Rackham School of Graduate Studies, University of Michigan, and the All Catfish Species Inventory (NSF DEB-0315963) to the first author. Fieldwork for the second author was supported by KFBG and grants to D. Dudgeon (HKU).

References

- Atoda, K. (1935) The larva of the catfish *Parasilurus asotus* L. *The Science Reports of the Tohoku University, Sendai, Japan. Fourth Series (Biology)*, 10, 29–32.
- Bornbusch, A.H. (1991) Redescription and reclassification of the silurid catfish *Apodoglanis furnessi* Fowler (Siluriformes: Siluridae), with diagnoses of three intrafamilial silurid subgroups. *Copeia*, 1991, 1070–1084.
- Bornbusch, A.H. (1995) Phylogenetic relationships within the Eurasian catfish family Siluridae (Pisces: Siluriformes), with comments on generic validities and biogeography. *Zoological Journal of the Linnean Society*, 115, 1–46.
- Chen, H.-L. (1977) A review of the Chinese Siluridae. *Acta Hydrobiologica Sinica*, 6, 197–218. [in Chinese with English summary].
- Chen, H.-X. (1984) Siluriformes: Siluridae. In: Chu, Y.-T. (Ed.), *The Fishes of Fujian Province (Part 1)*. Fujian Science and Technology Press, Fuzhou, pp. 388–392. [in Chinese].
- Chong, D.-H. & Dudgeon, D. (1992) Hong Kong stream fishes: an annotated checklist with remarks on conservation status. *Memoirs of the Hong Kong Natural History Society*, 19, 79–112.
- Dai, D.-Y. (1989). Siluriformes: Siluridae. In: Zheng, C.-Y. (Ed.), *Fishes of the Zhujiang River*. Science Press, Beijing, pp. 270–273. [in Chinese].
- Dai, D.-Y. (1999). Siluridae. In: Chu, X.-L., Zheng, B.-S., Dai, D.-Y. (Eds.), *Fauna Sinica. Osteichthyes. Siluriformes*. Science Press, Beijing, pp. 77–93. [in Chinese].
- Eschmeyer, W.N. (1998) *Catalog of fishes*. California Academy of Sciences, San Francisco, 2905 pp.
- Günther, A. (1864). *Catalogue of fishes in the British Museum. Vol. 5. Catalogue of the Physostomi, containing the families Siluridae, Characinidae, Haplochromidae, Sternopygidae, Scopel-*

- idae, Stomiidae in the collection of the British Museum. Trustees of the British Museum, London, 455 pp.
- Haig, J. (1952) Studies on the classification of the catfishes of the Oriental and Palaearctic family Siluridae. *Records of the Indian Museum*, 48, 59–116.
- Herre, A.W.C.T. (1933) *Herklotsella anomala* a new fresh water cat-fish from Hong Kong. *Hong Kong Naturalist*, 4, 179–180.
- Hora, S.L. (1937) Notes on fishes in the Indian Museum XXXIV. On a new catfish from Kwangsi, China. *Records of the Indian Museum*, 39, 341–343.
- Hora, S.L. (1938) Notes on fishes in the Indian Museum XXXVII. On a collection of fish from the Bailadila range, Bastar State, Central Provinces. A new name for *Silurus sinensis* Hora. *Records of the Indian Museum*, 40, 237–243.
- Kin Thant (1966) *Silurus burmanensis*, a new species of fish from the Inlé Lake, Southern Shan State, Burma. *Journal of the Burma Research Society*, 49, 219–221.
- Kobayakawa, M. (1989) Systematic revision of the catfish genus *Silurus*, with description of a new species from Thailand and Burma. *Japanese Journal of Ichthyology*, 36, 151–186.
- Liu, J.-Z. (1990). Siluriformes: Siluridae. In: Pan, J.-H. (Ed.), *The Freshwater Fishes of Guangdong Province*. Guangdong Science and Technology Press, Guangzhou, pp. 287290. [in Chinese].
- Mai, Đ.Y. (1978) [*Identification of the Fresh-water Fishes of North Vietnam*]. Science and Technology Publishing House, Hanoi, 339 pp. [in Vietnamese].
- Majumdar, N.N. (1951) Notes on Delhi fishes. *Journal of the Zoological Society of India*, 3, 243247.
- Man, S.H. & Hodgkiss, I.J. (1981). *Hong Kong Freshwater Fishes*. The Urban Council, Hong Kong, 76 pp.
- Mo, T.-P. & Chu, X.-L. (1986) A revision of the sisorid catfish genus *Glyptothorax* from China. *Zoological Research*, 7, 339–350. [In Chinese with English summary].
- Ng, H.H. (1999) *Pterocryptis inusitata*, a new species of silurid catfish from Laos (Teleostei: Siluriformes). *Ichthyological Exploration of Freshwaters*, 10, 371–374.
- Ng, H.H. (2004) The *Microsynodontis* (Teleostei: Siluriformes: Mochokidae) of the lower Guinea region, west central Africa, with the description of eight new species. *Zootaxa*, 351, 1–52.
- Ng, H.H. & Freyhof, J. (2001) A review of the catfish genus *Pterocryptis* (Siluridae) in Vietnam, with the description of two new species. *Journal of Fish Biology*, 59, 624–644.
- Ni, Y. & Wu, H.-L. (1986) Siluriformes. In: Anonymous (Ed.), *The freshwater and estuaries [sic.] fishes of Hainan Island*. Guangdong Science and Technology Press, Guangzhou, pp. 161–184. [in Chinese].
- Nichols, J.T. (1928) Chinese fresh-water fishes in the American Museum of Natural History's collections. A provisional check-list of the fresh-water fishes of China. *Bulletin of the American Museum of Natural History*, 58, 1–62.
- Nichols, J.T. (1943) *Natural history of Central Asia. Vol. 9. The fresh-water fishes of China*. American Museum of Natural History, New York, 322 pp.
- Parameswaran, S., Selvaraj, C. & Radhakrishnam, S. (1971) Notes on the life-history and biology of the catfish *Ompok pabda* (Hamilton). *Journal of the Zoological Society of India*, 23, 137–150.
- Roberts, T.R. (1989) Systematic revision and description of new species of suckermouth catfishes (*Chiloglanis*, Mochokidae) from Cameroun. *Proceedings of the California Academy of Sciences (Series 4)*, 46, 151–178.
- Tchang, T.L. (1936) Study on some Chinese catfishes. *Bulletin of the Fan Memorial Institute, Biology*, 7, 33–56.
- Tchang, T.L. (1960) *The Catfishes of China*. Peoples Education Press, Beijing, 67 pp. [in Chinese].
- Wiley, M.L. & Collette, B.B. (1970) Breeding tubercles and contact organs in fishes: Their occur-

- rence, structure, and significance. *Bulletin of the American Museum of Natural History*, 143, 143–216.
- Xie, X.-J. (1989) On the development of larva of *Silurus soldatovi meridionalis* Chen. *Acta Hydrobiologica Sinica*, 13, 124–133. [in Chinese with English summary].
- Yue, Z.-H. (1981) Siluriformes. In: Anonymous (Ed.), *The freshwater fishes of Guangxi Province*. Guangxi Peoples Press, Nanning, pp. 175–196. [in Chinese].